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NOVEMBER 17, 198

CHEMICAL & ENGINEERING

NEWS

Synthetic fibers holding up well, despite earlier forecasts
A Key Polymers Review Page 9

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Democrats take control of Senate

Page 22

CHEMICAL & ENGINEERING NEWS

Volume 64, Number 46
CENEAR 64 (46) 1–68
ISSN 0009-2347

NOVEMBER 17, 1986

News of the Week

■ **Accidental release of toxic chemicals into Rhine River causes public outcry.** **Page 4**

■ **Montedison, Italy's second largest firm, seeks to create a European Institute of Technology to foster international cooperation.** **Page 5**

■ **Public perception of contributions of engineering and technology is focus of two studies.** **Page 5**

■ **Union Carbide to sell and lease back its headquarters building and sell its electrical carbon business.** **Page 5**

■ **Although Clean Water Act has been pocket-vetoed by President Reagan, members of Congress vow to reintroduce bill.** **Page 6**

■ **EPA rules prohibiting land disposal of wastes containing dioxin and 21 solvents take effect.** **Page 6**

Business

Restraints on imported apparel and increase in consumer buying lift U.S. production of major synthetic fibers. **Page 9**

International Business

Mexico's petrochemical industry looks to future with optimism as the government makes changes to help make it a major exporter. **Page 14**

Science

Center for Catalysis & Surface Science at Northwestern encourages interdisciplinary approach to solve complex problems. **Page 33**

Chemists use exotic, short-lived organic radicals to test accuracy of theoretical picture of chemical bonding. **Page 34**

Technology

Japanese work on advanced materials is outpacing U.S. efforts, in line with aim for world dominance by the 1990s. **Page 35**

Books

The Bhopal disaster is the focus of two books that take a critical view of Union Carbide's attempts to resolve the legal issues. **Page 39**

Letters 2
Editor's Page 3

Concentrates

Business 7
Government 20
Science/Technology 32

The Departments

New Products 48
ACS Comment 49
ACS Focus 50
Meetings 53
Newscripts 68

Government

Now that the Democrats have gained a 10-seat majority in the Senate, items on the Democratic agenda are expected to receive more attention. **Page 22**

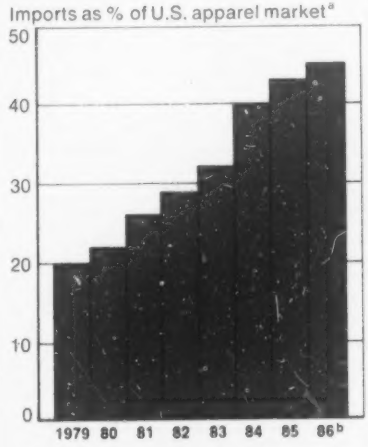
Restraints on Imported Apparel Lift Synthetic Fiber Output

Imports curbs, rising demand likely will end production declines for polyester and fibers this year; nylon fiber output to surpass 1985 level

Bruce F. Greek, C&EN Houston

Throughout the U.S. textile industry, and in particular the synthetic fiber segment, producers are beginning to achieve some success in opposing imports of apparel that have devastated the industry during the past decade. Because of stringent curbs on imported apparel and a rise in consumer buying, 1986 U.S. production of major synthetic fibers will come close to matching, if not exceeding, last year's output. Nylon fiber output likely will surpass that of 1985. If output of polyester and acrylic fibers fails to beat last year's, the decline will be 1% or less.

Imported apparel takes rising share of U.S. market



a Per cent of total fiber weight. b C&EN estimate. **Source:** Man-Made Fiber Institute

Nevertheless, a return to production volumes of the 1970s for the synthetic fibers could be some time in coming. Production in 1986 will be more than 20% below levels of the late 1970s and, with optimistic growth forecasts of 1 to 2% annually, previous production totals will not be matched until well into the 1990s. Because of capacity shutdowns and high capital costs for synthetic fiber plants, production may never match the previous levels for some fibers.

Key Polymers

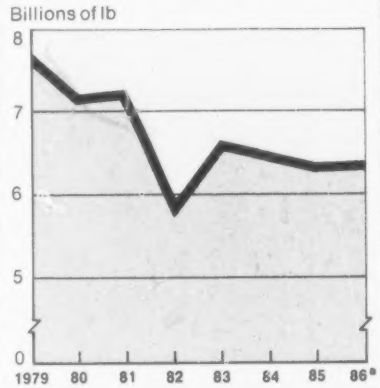
Because labor costs are lower in Pacific Rim countries, vast increases in imported apparel from them have resulted in declines in apparel manufacture and, thus, in synthetic fiber produced in the U.S. during the 1980s. The gap in labor costs may be closing because wage and benefit costs in the various Asian countries are increasing while those same costs in the U.S. garment industry are declining as a result of capital investment in new technology. Early in the 1980s, fiber exports rose to fill demands for textile manufacture in the garment-making countries. More recently, exports have declined as local fiber manufacture has developed to fill most needs in that area of Asia. Longer term, U.S. fiber production may get some pressure, as the net of exports over imports reverses unless constraints are put on fiber imports in addition to those on garment imports.

Yet, imports of apparel can be combated economically, according to industry sources. The long lead times required between orders for foreign-made garments and delivery increases the risk of losing consumer acceptance and, if garments rapidly fade from fashion, then high markdowns needed to move the apparel can reduce or end profits. A U.S. program for responding quickly to retailers' wants has developed over the past two years throughout the manufacturing chain—from fiber makers through textile mills and mill suppliers to garment makers. Retailers currently can get delivery within two months of orders placed in the U.S. in contrast to a minimum of six months (and a more usual eight months) from foreign sources.

Through this quick response program, the "buy American" program, and because of quotas set by the various multifiber agreements, the growth rate of imported apparel this year has slowed. Those efforts have accounted in part for the improvement in synthetic fiber production.

For details of the near-term outlook for polyester, nylon, and acrylic fibers, please see the following pages.

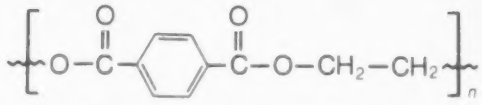
Output of major synthetic fibers turns up slightly



Note: Excludes cellulosic and olefin fibers. a C&EN estimate. **Source:** Textile Economics Bureau

Key Polymers

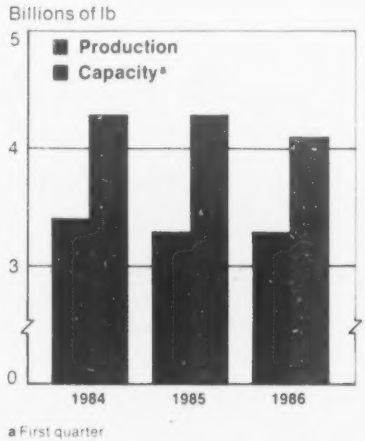
Polyesters



Poly(ethylene terephthalate)

- ***Output off a bit***
- ***Capacity excessive***
- ***Prices pressured***

PRODUCTION/CAPACITY



[a] First quarter

MAJOR PRODUCERS

Allied-Signal, American Hoechst, BASF, Celanese, Du Pont, Eastman Chemical

HOW MADE

Ethylene glycol and dimethyl terephthalate or terephthalic acid reacted to make bis(2-hydroxyethyl) terephthalate (methanol as coproduct if using DMT), which is condensed catalytically to poly(ethylene terephthalate) and coproduct ethylene glycol

MAJOR END USES

Apparel 50%, home furnishings 20%, industrial 30%

FOREIGN TRADE

Exports—expected to fall to about 200 million lb, imports—to rise to about 90 million lb

PRICES

Round 150-denier yarn 80 cents per lb, staple 70 cents per lb

Polyester fiber output will be down again in 1986, primarily as a result of ever-higher imports of apparel containing these fibers. The decline, however, will be less than that of the past two years. Meanwhile, plant capacity has declined more than production, thereby raising the average operating rate. Polyester fiber production this year also will be affected by other, diverse factors, such as lowered cotton prices, declining fiber exports, and rising fiber imports.

Drops in volume of polyester fiber output have become smaller in recent years. For example, production in 1986 is now forecast to decrease as little as 20 million lb, to 3.32 billion lb, or less than 1%. This year's decline, if it does occur, will follow a 1985 decline of about 50 million lb, to 3.34 billion lb, or 1.5%. Production ranging from 3.3 billion to 3.4 billion lb is down significantly from the peak years of 1979 and 1981 when it was almost 4.18 billion lb.

Capacity to make polyester fibers has slipped to about 4.1 billion lb. Actual operable capacity varies with the size (denier) of fiber being produced and with the time of the year. On the basis of a nominal 4.1 billion lb of capacity and a 1986 output of 3.3 billion lb, the average operating rate will be about 80%. This rate is up from 77% in 1985.

Even with declines in production during the past five years, polyester fiber remains the largest volume fiber consumed in U.S. textile mills. For the past 10 years, it has exceeded consumption of cotton, the next largest volume fiber, and also accounts for about 40% of consumption of synthetic fibers by U.S. mills.

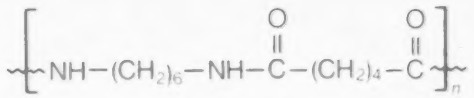
In August, cotton prices fell substantially and have just recently recovered somewhat. Lower cotton prices coupled with relatively stable polyester prices suggest that fabrics made of blends of these two fibers will be shifted toward a higher cotton content.

Imports, however, have had the biggest effect on polyester demand. Apparel imports, combined with fashion changes, have especially hurt filament demand during the 1980s. Consumer demand has shifted toward spun fabrics (either knitted or woven), which have an appearance closer to natural fiber (especially wool) fabrics. Consumer demand for fabrics made of filament fibers has favored imported apparel because of its lower cost. These trends have continued in 1986 as output of polyester staple fiber has risen, and that of filament has declined.

Not surprisingly, polyester fiber producers and textile mills using polyester are shifting their production toward products that can compete with imported apparel. In addition to lowering labor costs, all parts of the apparel manufacturing chain are working toward bringing out new garments with greater fashion appeal and better durability. Success of these programs waxes and wanes as foreign producers copy and supply similar garments and as fashion changes. However, apparel still accounts for about 50% of U.S. polyester fiber consumption.

The home furnishings use of polyester fibers has grown little. Recently, much of the growth has been in increased polyester use in bed linens and in upholstery (which includes fabrics used in automobiles). Both fashion and performance properties of polyester fibers have been responsible for these gains. Many of the other uses, such as fiberfill and curtain/drapery, are past major growth spurts and depend on demographic growth and replacing other materials for any gains.

Industrial uses of polyester fibers amount to about 30% of total consumption and have been dominated by tire cord. The market for tire cord has declined because of changes in tire construction, size, and life, and tire imports. Belt and hose reinforcement growth has slowed. Currently, the fastest growing industrial use remains the nonwoven fabrics, which mainly use polyester staple.

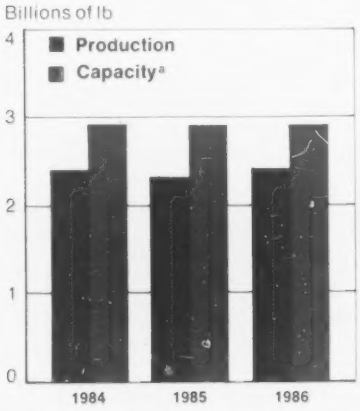


Nylon 66

Nylon

- ***Production up slightly***
- ***Capacity on hold***
- ***Prices improved***

PRODUCTION/CAPACITY



a First quarter

MAJOR PRODUCERS

Allied-Signal, BASF, Du Pont, Monsanto

HOW MADE

Nylon 66—adipic acid and hexamethylene diamine reacted to form hexamethylene diammonium adipate, which is polymerized by removal of water at elevated temperature, pressure; nylon 6—caprolactam and water reacted to form aminocaproic acid, which is polymerized by removal of water

MAJOR END USES

Home furnishings 65%, apparel 20%, industrial 15%

FOREIGN TRADE

Exports—to hold at about 140 million lb, imports—rising to about 150 million lb

PRICES

Carpet staple $1.40 to $1.70 per lb, low-denier textile fiber $1.80 per lb

Nylon fiber producers are expecting a better year than last. They also will have a better year than 1983 or 1984—the best production years since the peak in 1979. Consequently, they will use a higher fraction of the capacity that has held at close to 2.9 billion lb so far in this decade. Nylon fiber output has been increasing as a result of demand for carpet in housing and for specialty uses in apparel. Growth in carpet demand continues to outstrip that in other uses of nylon, including exports.

With estimates coming in on third-quarter production of nylon fibers, forecasts for 1986 total production are beginning to cluster around 2.45 billion lb, up more than 4% from 1985. It also would be more than the 2.41 billion lb produced in 1984. Fourth-quarter production will determine whether the total will reach a record 2.5 billion lb this year.

Capacity to make nylon fibers varies, and estimates of capacity are less precise than those of production. If, at the beginning of 1986, capacity held at 2.9 billion lb and the year's production totals 2.4 billion lb, then the average operating rate would be about 83%—higher than last year's rate of about 79%.

Prospects for the different nylons—6 and 66 (or 6/6)—are influenced by different segments of demand, which cause variations in operating rates. For example, several types of carpet nylon have remained in strong demand so far in 1986, requiring plants that produce the fiber for carpet to run at higher rates than those producing fiber for apparel and industrial uses. Nylon carpet fiber production is practically unaffected by imports. Except for specialty area rugs, little carpeting sold in the U.S. is imported. By contrast, various apparel uses of nylon fibers have been affected by imports of nylon apparel—enough to cause a demand decline in recent years. The differences in the impact of imported fabricated products on consumption of nylon depends on the amount of labor required in the fabrication. Carpet, for example, now requires much less labor for its manufacture because of developments more than 30 years ago in tufting machinery and in the bulked continuous-filament textured yarns.

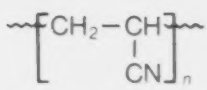
Because of these developments in nylon fibers and carpet making, nylon has dominated the carpet fiber market since the early 1970s. Efforts by producers of other fibers to move into this market generally have been rebuffed, as nylon fibers were improved in such properties as stain resistance, durability, and elimination of static shock. Polypropylene has increased its share of carpet fiber consumption, but it has been at the expense of polyester's use in carpet.

A newer development, that of the "carpet tile," has helped nylon. The squares of completed carpet appeal to do-it-yourselfers because of ease in installation.

Other factors also are spurring nylon carpet demand. From a commercial standpoint, carpeted areas are less expensive to maintain than vinyl or other tiled areas. Furthermore, capital costs are not that much different, allowing carpet to continue its hold on this market.

Apparel use of nylon has turned up again after a long slide. Much of the modest growth stems from increased demand for nylon fibers in outerwear garments, where competition from imported apparel still is strong. Fashion also influences the selection of fiber for many apparel uses, causing some variation in demand from year to year.

Industrial use of nylon includes tire cord, a market that has slipped away from nylon except for heavy-duty tires. Even these markets are being eroded by polyester and steel as well as rising imports of tires and lower sales of farm equipment. Other industrial markets, such as belting and hose, are not growing.

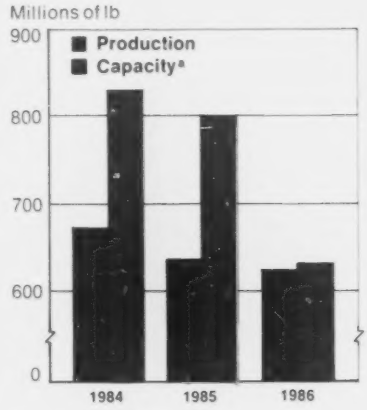


Polyacrylonitrile

Acrylics

- ***Production slipping***
- ***Capacity reduced***
- ***Prices up slightly***

PRODUCTION/CAPACITY



[a] First quarter

MAJOR PRODUCERS

American Cyanamid, BASF, Du Pont, Monsanto

HOW MADE

Polymerization of acrylonitrile with small amounts of other acrylate comonomers

MAJOR END USES

Apparel 65%, home furnishings 30%, industrial 5%

FOREIGN TRADE

Exports—dropping to below 100 million lb, imports—rising to about 65 million lb

PRICE

3-denier staple for apparel about 85 to 95 cents per lb

Production of acrylic fibers turned around this year. Output of these fibers—smallest in production volume of the major noncellulosic, nonolefin synthetic fibers—increased this summer on the strength of rising demand. Earlier indications were for another year of decline in production.

Last year's extensive capacity shutdown also has been reversed, with some capacity restarted as early as midyear. Inventories have been drawn down, which could mean that relatively high production rates will continue for some time even if demand should fall. However, exports, which could slide to about half the 1985 volume, constitute one big negative factor facing acrylic fiber producers.

A production surge in the third quarter has boosted this year's output of acrylic fibers, including the modacrylic fibers. (Modacrylics contain less than 85% acrylonitrile as well as other comonomers, mainly chlorinated hydrocarbons such as vinyl chloride.) Output will nearly match, and possibly slightly exceed, the 631 million lb produced last year. Output in 1985 decreased 6% from the previous year's production of 671 million lb. That decline led to forecasts for a 5% decline in 1986 production to 600 million lb, based largely on a projected decline in exports.

During the first half of 1986, production was off less than 5%, about in line with forecasts. Then, demand for acrylic fibers in some fabrics, such as fleeces used in warmup suits, expanded and began to push production because inventories had been reduced during the first half of the year. Consequently, production has been stepped up to meet added demand and to build more inventory. Production in the second half of the year now is forecast to be up 5 to 10%, offsetting the decline in the first half and allowing 1986 output to about match that of 1985.

If output does hit 630 million lb, capacity will have to run at nearly 100% of the average nameplate total for the year. After various shutdowns of capacity in 1985 and earlier, capacity at the beginning of 1986 was about 630 million lb. At mid-1986, Du Pont reported startup of 20 million lb of shutdown capacity, thereby adding about 10 million lb to the nameplate for the year. Other capacity startups, plus a small amount of debottlenecking and spinning-process inprovements, could add slightly to the capacity total.

Actual U.S. consumption of acrylic fibers has increased even while production was declining. Domestic shipments of acrylic fibers in first-half 1986 rose more than 18% over the year-ago level. This gain reflects the demand growth for the fiber in fleece garments, a further shift toward acrylic fiber use in sweaters, spurred partly by fashion changes, and growth in other smaller end uses.

A gain of 41.8 million lb in first-half domestic shipments was more than offset by a decline in exports of 55.1 million lb, a slump of more than 50% from exports in first-half 1985. The decrease in exports so far this year—reduced by the gain in domestic shipments—accounts for about half of the production decline, with the remainder caused by inventory reduction and a small increase in imports of acrylic fibers.

Although domestic shipments of acrylic fibers for making fabrics (circular knits) that go into fleece garments and for making sweaters has improved, the consumption pattern for acrylic fibers is not changing appreciably. Apparel will continue to dominate. Textile companies have improved their competitive position, relative to imports, through modernization of their knitting plants and through advances made in fabrics to attract designers toward acrylics. The other major end-use categories, home furnishings—large'y blankets, draperies, and outdoor items such as awnings and furniture covers—and industrial, are growing moderately, but not enough to greatly influence demand for acrylic fibers.

Optimism Returns to Mexico's Petrochemical Industry

New government edicts give private sector more freedom to operate and recent government report details long-term plan for industry

Earl V. Anderson, C&EN New York

After an absence of several years, optimism has returned to the Mexican petrochemical industry. With the country still facing severe economic problems, an inflation rate that's flirting with the 100%-per-year level, and a huge foreign debt, it's a guarded optimism, to be sure.

Nevertheless, Mexican petrochemical producers, particularly in the private sector, feel more confident about their future than they have in a long time. Recent developments have combined to generate this new burst of optimism. New government edicts give the private (secondary) petrochemical sector new freedom to operate. And a recently issued government report spells out more realistic long-term goals for Mexico's petrochemical industry and outlines a plan to achieve them.

In addition, Mexican chemical companies are encouraged by the fact that Mexico has finally joined the General Agreement on Tariffs & Trade (GATT). Carlos Pani, director general of ANIQ, Mexico's chemical industry trade association, says that if the industry wants to export—and it does—it must play by the rules of the world export market. "We can't be a major chemical exporter if we continue to play by our own rules," Pani says.

Contrary to many other Mexican industrialists, the country's petrochemical producers welcome the competition that GATT membership surely will bring. They are convinced the industry must become a more efficient producer. The new international competition that will result from belonging to GATT will act as an incentive to achieve new levels of efficiency, Pani says.

But GATT membership alone isn't responsible for the industry's newfound optimism. Last month, the federal government issued a resolution that redefined primary and secondary petrochemicals. By law, primary petrochemical output in Mexico is reserved for Petróleos Mexicanos (Pemex), the state oil company.

Generally, primary petrochemicals include the basic materials such as ethylene, propylene, and benzene and first derivative products such as ethylene oxide and polyethylene. The private, secondary petrochemical sector could produce only products that were further downstream.

Now, however, the new redefined lists allow the secondary petrochemical industry to make several products that previously were reserved solely for Pemex. Among the more important products is polypropylene.

Among the 36 petrochemicals now listed as secondary petrochemicals are several already produced by private companies, but by old, inefficient processes. The new resolution now allows these products to be made by more efficient processes than those currently used. These products include vinyl acetate, acetic acid, acetic anhydride, butyl alcohol, butyraldehyde, and 2-ethylhexanol.

This new resolution can be criti-

These products are tagged for investment priority in Mexico

Thousands of metric tons per year	Minimum desired capacity
INTERMEDIATES	
Terephthalic acid	70
Acrylates	30
Maleic anhydride	6
Sodium cyanate	8
Divinylbenzene	12
Dimethyl terephthalate	40
2-Ethylhexanol	40
Phenol	50
Nitric acid	100
Nitrotoluene	40
Toluenediamine	20
Aniline	30
Acetanilide	30
Hydroquinone	3
Vinyl acetate	120[a]
Acetic acid	—
Acetic anhydride	—
Benzoic acid	1.5
Bisphenol-A	10
Chloromethanes	45
Ethyleneamines	1.5
Butyraldehyde	90
Caprolactam	50
RESINS	
Styrene copolymers	1.5
Polyethylene terephthalate	30
Acrylonitrile-butadiene-styrene	15
Polyvinyl alcohol	3
Polystyrene	40
Polycarbonates	8
Polyvinyl butyral resins	3
FIBERS	
Polyester	20
ELASTOMERS	
Styrene butadiene	25
Polybutadiene	25
Butyl	30
Thermoplastic elastomers	10
Nitrile	3
Chloroprene (neoprene)	10
SPECIALTIES	
Benzaldehyde	5
Glyoxal	1.5
Dichloroaniline	12[b]
Methionone	3

a Capacity includes acetic acid and acetic anhydride. b Capacity includes coproducts such as diphenylamine and nitroaniline. **Source:** Secretaria de Comercio y Fomento Industrial

Mexico thinks its position as basic petrochemical exporter will deteriorate

Competitive level	Basic petrochemical export strength, 1982					Basic petrochemical export strength, 2000				
	Ammonia, methanol	Ethylene	Propylene	Butadiene	Aromatics	Ammonia, methanol	Ethylene	Propylene	Butadiene	Aromatics
Strong	Mid-East Canada	Mid-East Canada	West Europe U.S.	West Europe U.S.	U.S.	Mid-East Canada Oceania	Mid-East Canada			U.S. East Europe
Favorable	**Mexico** U.S.	**Mexico** U.S.	**Mexico** Mid-East	Mid-East	Canada West Europe Japan		Oceania	Canada **Mexico** U.S.	West Europe U.S.	West Europe **Mexico**[a]
Vulnerable	West Europe	West Europe	Japan	Japan **Mexico** Canada	Mid-East **Mexico**	**Mexico** U.S.	**Mexico** U.S.	Mid-East West Europe Oceania	**Mexico**	Canada
Weak	Japan	Japan				East Europe West Europe	East Europe West Europe	East Europe	Mid-East Oceania	Mid-East Oceania

a Competitive level falls between favorable and vulnerable. **Source:** Pemex (Petróleos Mexicanos)

cized as inconsistent. Polypropylene, for instance, can now be made by private companies but polyethylene still cannot. However, Lars Christianson, director of Christianson S.A., calls it "a tremendous step forward."

How many private companies will actually take advantage of this new petrochemical ruling remains to be seen. The Mexican rumor mill has it, however, that some Mexican companies and possible U.S. partners are seriously considering polypropylene, propylene oxide, and butyraldehyde.

Private petrochemical producers in Mexico also have won freer access to imported raw materials. Until recently, they had to get all of their petrochemical raw materials

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C&EN/17.11

SNPE

CIRCLE 46 ON READER SERVICE CARD

from Pemex. If Pemex couldn't produce enough to meet demand—as was often the case—then Pemex would import the basic petrochemicals and resell them to its customers.

Now secondary petrochemical producers in Mexico can import their primary petrochemical raw materials directly, without having to use Pemex as an intermediary. This, says one Mexican chemical industry observer, is another step toward allowing the secondary petrochemical industry to operate in an open economy.

As a morale builder, a recently released government report is just what the doctor ordered for Mexico's private petrochemical producers. This report, a joint effort of the Secretaria de Comercio y Fomento Industrial; Secretaria de Energia, Minas, e Industria Paraestatal; Pemex; and ANIQ, was three years in the making.

ANIQ's Carlos Pani says that it was worth the wait. The report definitely establishes the petrochemical industry as a "priority" industry. And, although the report has no power of law behind it, it does have a lot of power of persuasion.

The report, An Integrated Program for Petrochemical Industry Development, covers a lot of subjects, from technology and environmental policies to regional development and fiscal policies. Its major thrust, however, is to make Mexico's petrochemical industry a major exporter with a substantial balance of trade surplus.

In the report, Mexico finally recognizes what international chemical experts have long known—Mexico has a weak and declining position as an exporter of basic petrochemicals. As a result, the report stresses that the best way for Mexico to export primary petrochemicals is to convert them in Mexico to secondary petrochemicals and end products, then export these materials to world markets.

Using this strategy, the report says that basic petrochemical demand to make exportable products likely will reach 30% of domestic demand for the basic petrochemicals. If so, total basic petrochemical demand in Mexico will reach 27.2 million metric tons in the year 2000, three and a half times what it was in 1983.

This strategy has a price tag, however. To completely satisfy domestic demand and have enough basic petrochemicals left to convert to upgraded products for export, Mexico will have to invest an average $800 million per year between 1986 and 2000. This investment is expected to enable Mexico to eliminate an average $250 million annually in basic petrochemical imports and produce an excess of $600 million per year of basic petrochemicals. But this $600 million excess, says the report, can be transformed into $6 billion worth of exportable products. □

There is a growing demand for

PTMEG

QO Chemicals is...

-a major producer of PTMEG
-expanding PTMEG production capacity by 40%
-adding 650 molecular weight PTMEG
-committed to long-term service of the PTMEG market

QO Chemicals is expanding along with the growing demand for PTMEG (polytetramethylene ether glycol). QO® POLYMEG® PTMEG, the only PTMEG produced from biomass, will soon be produced in greater volume than ever before as a result of a 40% expansion of production capacity. Our product line has been broadened by the addition of POLYMEG® 650 polyol to our POLYMEG® 1000 and 2000 molecular weight PTMEG. These actions will enable us to better meet the need of the plastics, rubber, coatings, fiber, and other industries where PTMEG is used for high-performance materials. POLYMEG® polyols are backed by the traditional service you expect from QO Chemicals. Give us an opportunity to discuss your requirements.

For further information, write or call:

QO Chemicals, Inc.
823 Commerce Drive
Oak Brook, IL 60521
312/572-2308

QO CHEMICALS

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